

## CLAIMS

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1. An x-ray generator comprising an electron gun, electron focusing means, a target and electronic control means, wherein an area of the target on which the focusing means causes electrons from said electron gun to impinge comprises an x-ray source emitting an x-ray beam, the control means being adapted to control the electron focusing means so that the x-ray source on said target may be varied in size, wherein the x-ray generator further comprises a shutter to control the emitted x-ray beam, and wherein the control means includes a switching means to switch the electron focusing means between a first unfocused state in which the x-ray source has a first area upon action of the shutter and a second focused state in which the x-ray source has a second area smaller than said first area when the shutter is open.

2. The x-ray generator according to Claim 1, wherein said first area has a surface area at least twice that of said second area.

3. The x-ray generator according to Claim 1, wherein said first area has a surface area at least four times that of said second area.

4. The x-ray generator according to Claim 1, wherein said first area has a surface area at least ten times that of said second area.

5. An x-ray generator comprising an electron gun, electron focusing means, a target and electronic control means, wherein the area of the target on which the focusing means causes electrons from said electron gun to impinge comprises an x-ray source generating an x-ray beam output, the control means being adapted to control the electron focusing means so that the x-ray source on said target may be varied in size, wherein the control means includes a switching means to switch the electron focusing means between a plurality of focused states, whereby in each state the x-ray source is in a corresponding discrete stationary position on said target.

6. The x-ray generator according to Claim 5, wherein the electron gun comprises an evacuated tube, and wherein the electron focusing means comprises an x-y deflection system for centering the electron beam in the tube.

7. The x-ray generator according to Claim 6, wherein the electron beam focusing means further comprises at least one electron lens.

8. The x-ray generator according to Claim 7, wherein said electronic lens comprises an axially symmetric or round lens for focusing the electron beam to a line focus and for steering the electron beam.

9. The x-ray generator according to Claim 7, wherein said electron lens comprises at least one quadripole or multipole lens for focusing the electron beam to a line focus and for steering the electron beam.

10. The x-ray generator according to Claim 5, wherein the target is a metal selected from the group Cu, Ag, Mo, Rh, Al, Ti, Cr, Co, Fe, W, Au.

11. A method for extending the life of a target of an x-ray generator, wherein the generator comprises an electron gun, electron focusing means and a target, the method comprising the steps of:

firing electrons at the target such that the area of the target on which the focusing means causes electrons from said electron gun to impinge comprises an x-ray source emitting an x-ray beam,

controlling the emitted x-ray beam by action of a shutter in its path, and

controlling the electron focusing means by the action of the shutter to move between a first unfocused state in which the x-ray source has a first area and a second focused state in which the x-ray source has a second area smaller than said first area, the intensity of electron impingement in the first state being sufficiently low to reduce target degradation, the intensity of electron impingement in the second state being

sufficiently high such that the source produces a predetermined required level of brightness and source size on the target.

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5 12. The method according to Claim 11, wherein the electron beam current is substantially the same in the first and second states, while the intensity of the beam per unit area at the target is lower in the first state than in the second state.

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10 13. A method of extending the life of a target of an x-ray generator, wherein the generator comprises an electron gun, electron focusing means and a target, the method comprising the steps of:

firing electrons at the target such that the area of the target on which the focusing means causes electrons from said electron gun to impinge comprises an x-ray source, and

15 controlling the electron focusing means to move between a plurality of focused states, whereby in each state the x-ray source is in a corresponding discrete stationary position on said target, such that the intensity per unit area in each discrete position is substantially constant, and such that there is no overlap on the target between the discrete positions corresponding to each focused state.

# METHOD AND APPARATUS FOR PROLONGING THE LIFE OF AN X-RAY TARGET

## ABSTRACT OF THE DISCLOSURE

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An X-ray generator comprises an evacuated and sealed X-ray tube, containing an electron gun and an X-ray target. An electron beam is produced by the electron gun in which the cathode is at negative high voltage, the electron gun consisting of a filament just inside the aperture of a Wehnelt grid which is biased negatively with respect to the filament. Two sets of beam deflection coils, are employed in two planes, mounted between the anode of the electron gun and the focussing lens to center the beam. Between the focussing lens and the target is an air-cored quadripole magnet which acts as a stigmator in that it turns the circular cross-section of the beam into an elongated one. This quadripole can be rotated about the tube axis so as to adjust the orientation of the line focus. The beam can be moved about on the target surface by controlling the currents in the four coils of the quadripole.